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Some Common Maintenance Problems and Building Defects: Our Experiences

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Abstract

Poor and improper building maintenance will definitely cause more damages and costly repair works if left unattended. In Malaysia, buildings are built in accordance with British Standard and under strict supervision. Unfortunately the maintenance aspects of the building are still weak. Making it worse, sometimes building maintenance is perceived as merely about the mechanical and electrical system in the buildings without much consideration given to civil and structural elements. This non-research paper is to discuss the common maintenance problems and building defects on civil and structural elements at the Social Security Organisation (SOCSO) buildings across Malaysia due to various factors. Some common problems involving water proofing system, cracks, soil settlement are discussed in this paper. For instance, with tropical climate and average rainfall of 250 centimetres in a year, a good water proofing system is crucial for buildings with flat roof in Malaysia. However the performance of water proofing systems depend on many factors i.e. quality of the materials, the skill of workers, application methods, substrates condition, weather, maintenance, etc. Recent roof leakage incidents at numerous prestigious buildings such as parliament house, high court and other government buildings has sparked more awareness among the engineering fraternity on the importance of good and systematic building maintenance. With 34 office buildings throughout Malaysia, Property Division of SOCSO has been dealing with such problems regularly and would like to share them with other participants of this conference.

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1. Introduction

Malaysia is one of the fast growing economies in South East Asia. With first class infra-structures, government of Malaysia is really concern about the importance of building maintenance aspect. Even though the concept of building maintenance has already existed in Malaysia since modern buildings were constructed the typical understanding and approaches require changes in order to suit to the current scenarios and demands. To some parties, maintenance of building is a complicated process and costly but if it is carried out wisely it could save money besides potential extended life span of the building. The maintenance process must involve two types of maintenance i.e. preventive maintenance and corrective maintenance. Of the two, preventive maintenance is more crucial and those who involve in the development of building must understand the importance right from the beginning of the projects. Architects, engineers, planners etc should study the potential maintenance and operational problem before working out the design. This paper is presented with an attention to share our experiences on some building defects and maintenance problems from the building owner's perspective.

2. Waterproofing Issues

To suit a modern concept of design and ease of maintenance, many building owners in Malaysia have opted for a flat roof concept rather than traditional pitched roof. However due to a relatively high annual average rain intensity in Malaysia of 250 cm, the problem that mostly associates with the flat roof is a waterproofing-related issues.

The following table indicates the type of problems that associated with the respective SOCSO buildings encountered in 2010.

Table 1. Waterproofing System at SOCSO buildings with flat roof.

Building Location	Waterproofing System	Leakage problem in 2010
Kuala Lumpur (Headquaters)	Liquid	-
Kuala Lumpur	Bituminiuos membrane (4mm)	-
Alor Setar	Liquid	-
Seberang Jaya	Liquid	√
Georgetown	Liquid	-
Ipoh	Bituminiuos membrane (4mm)	-
Petaling Jaya	Bituminous membrane (4mm)	-
Seremban	Cementitious	-
Melaka	Liquid	-
Johor Bahru	Bituminous membrane (3mm)	√
Kuantan	Bituminous membrane (3mm)	√
Kota Bharu	Bituminous membrane (4mm)	√
Terengganu	Cementitious	√
Kuching	Cementitious	√
Kota Kinabalu	Cementitious	-

Figure 1 and Figure 2 show the condition of defective waterproofing system at some of SOCSO buildings.

From the above, the bituminous membrane causes regular problem which we identified its root causes as follows:

- The burning process of membrane was not properly carried out resulting weak bonding to the substrates. Water may have tracked between the membrane and the slab thus makes it difficult to trace the source of the leak.
- No screed to protect the membrane from punching forces.
- Failure to repair minor defects at early stage that escalated to become major.

Figure 1. Failed Torch-on Membrane at SOCSO Seberang Jaya Office.

Figure 2. Damaged Liquid-Type water proofing layer at SOCSO Melaka Office.

Some problems could have been avoided much earlier if the installer strictly followed the instruction such as constructing angle fillet at corners, fully cleaned the substrate surface prior to installation, accurately mixed component A with component B, etc. Our record shows that a 4 mm thick membrane performs better if compare to that of 3 mm. The reason being that the burning process is more ‘stable’ and easier resulting better bonding to the slab. Our records also concede the fact that flat roofs are usually more vulnerable to leakage problems compare to that of pitched roof (Douglas and Ransom, 2006).

2.1 Warranty Issues

Normally manufacturers offer 5 to 10- year warranty for their products that tied together with performance warranty. It means that beside the guaranteed products, it also covers the quality of worked carried out by their licensed applicators (SOCSO 2011). Even though it looks beneficial to the client but its reliability is arguable as manufacturing companies might still exist toward the end of the warranty period but the licensed applicators may have closed down their business. If this happens the warranty does not carry any weight and benefit to the building owners. As a result building owners may tend to choose non-branded products that only offer 1 to 2 years with much cheaper cost for the next round of repair.

2.2 Workmanship

Workmanship issues are always associated with small contractors as they are not well trained to be in the construction industries. In Malaysia small size construction companies are categorised as Class F and allowed to carry out works worth below MYR 200,000.00. In many cases their quality of works is low due to lacks of experiences and improper guidance from the relevant parties.

Workmanship issue does not arise among established contractors/suppliers as they have strong financial record and expertise in carrying the works. Malaysian government through various entities has been making efforts to improve knowledge and skill of those small contractors by conducting field training, seminar and short courses.

3. Cracks

A typical crack of buildings in Malaysia is of non-structural type i.e. shrinkage cracks, joint cracks, etc. Surface cracks are commonly found on the floor screed and normally caused by improper curing process. Joint cracks are commonly seen at the joint of different structural elements such as column / brick wall and beam / brick wall. The common causes of such cracks are identified due to the difference thickness of plastering on those structures and insufficient bonding element that holds bricks to the column or beams. Other area of cracks is around the opening such as for windows and doors. These kinds of crack can be repaired easily with straight forward methods such as applying repair mortar / putty onto the affected area (for cracks < 3mm) together with suitable wire meshes provided the surface preparation is carried out in proper ways. In some cases, corrosions of steel reinforcement were detected and these incidents indicated that immediate repair was not carried out at early stage. The measurement of crack progress was carried out using crack gauge to ensure no further crack movement prior to the repair works. Figure 3 shows a crack gauged installed on the wall of our office to measure the crack progress (SOCSO Maintenance Report For August ,2011).

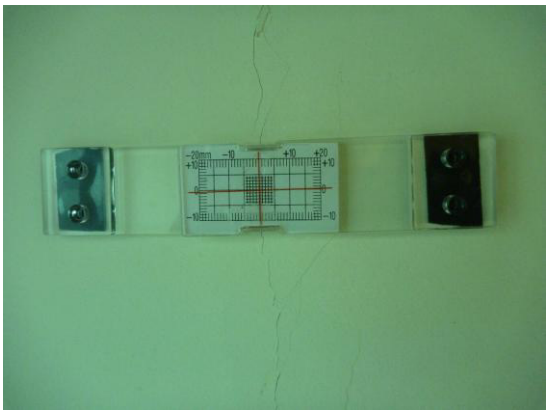

Figure 3. Measurement of cracks by using crack gauge plate.

4. Soil Settlements

In some swampy areas in Malaysia, soil settlement is critical to buildings and infrastructures. For SOCSO buildings, the most affected areas are building aprons, retaining walls, perimeter roads and fencings. In one of the remedial works carried out at SOCSO building in Penang, a slab lifting method was used where a special resin was injected into the ground at various levels so that it mixes and improves the soil properties. For area of approximately 300 m2, it took 5 days to finish which is much faster compare to other method despite its higher cost that the client had to bear. After 2 years of the treatment, the recorded settlement was 3mm and considered acceptable (SOCSO Maintenance Report For January 2011). Figure 4 and Figure 5 show the improvement before and after the treatment whilst Table 2 indicates the properties of the resin used.

Figure 4. Soil settlement before treatment.

Figure 5. After treatment.

Table 2. Physical properties of the injection resin

Density	ASTM D1622	3.69 lb/ft3
Open/closed cell	ASTM D6226	88.5%closed 6.8% open
Compressive strength	ASTM D1621	53.2@yield 52.6 @ 5% deflection 47.1 @ 10% deflection
Tensile Properties	ASTM D1623	65.1
Flexural Properties	ASTM D790	196.4 modulus 104.9 max. strength
Rigid resin shear	ASTMC273	41.8 Stress 350.1 modulus
Thermal conductivity	ASTM C518-98	0.219 KBTU/Hr(ft2)(F/in)
Dimensional stability	ASTM D2126 (7-day testing)	HOT: -0.9% (1000°C/amb. RH) COLD: -0.6% (-30°C/ amb. RH) 70°c/95% RH:-4.0%

In another project sited near a river, the design consultant decided to use raft foundation for a portion of the car porch in front of the building whilst the main building is supported by piles. After one and a half years, differential settlements started to occur. Since the project was implemented under the 'design and built', the client had to instruct the contractor to repair the defect but the respond was slow as they had to consult the design consultant. As a result, the cracks propagated and required more money for the repair (SOCSO Maintenance Report For May 2011).

5. Wall Finishes Problem

Most of the finishes of facade for SOCSO buildings are of plaster and paint except for SOCSO Kuala Lumpur which is of aluminium cladding. It is common to see that the wavy surface of plaster due to poor workmanship. Since this problem is common in Malaysia, SOCSO decided to have the external walls of the new buildings roughen with mortar prior to painting. With this kind of finishes, the texture could hide the uneven plastering surface on the large surface. The only problem is that repair of the surface should any defects occur would be a bit more difficult. Another issue with the external wall is an efflorescent (whitish bleeding) spotted on the wall surface which occurred due to chemical reaction of the wall materials and high moisture content on the wall prior to painting process. This problem can be resolved by completely removing the finishes on the affected areas and subsequently repainted it in the suitable condition. Figure 6 shows an efflorescent problem encountered on the external wall of SOCSO office in Kedah (northern part of Malaysia) (SOCSO Maintenance Report For May 2011).

Figure 6. An efflorescent signs.

6. Staining

After few years of painting, most of the building facades experienced staining problems such as water mark, existence of moss, fungus and algae attacks, etc. To minimize these problems, SOCSO was using high quality external paint containing anti-fungus agents. It may not offer a total solution but it helps to prolong a good appearance of the buildings.

7. Lacks of Knowledge and Expertise on Maintenance Aspects.

It is common that the building maintenance is merely interpreted as an aspect of maintenance of building system such as elevators, air conditioning, lighting, etc. Therefore the maintenance group are dominated by those with mechanical and electrical background with limited knowledge on civil and structural aspects. As a result, the repair approach for the particular area is not so good that resulting the problems to recur.

SOCSO has been taking appropriate measure by getting the expertise of their civil engineers to regularly monitor the condition of the buildings as a preventive measure. If any defects occur, the engineer would then come up with the best solution of the repair works and closely monitors its implementation. In other words, preventive measure is a routine and well scheduled process whilst corrective measures are carried out after the defects occur. (Mat Deris, 2007)

8. Conclusions

Even though this paper may not thorough enough to indicate the whole scenario of building and defect problems in Malaysia, it tries to give an overview on the common problems facing by the building owners in Malaysia.

As a conclusion, building maintenance aspects in Malaysia requires more involvement from civil engineers as their inputs are not less important compare to that of mechanical& electrical. For instance, immediate repair is really important in preventing the propagation of the defects such as structural cracks, soil settlements, leakage, etc.

In the other hand, engineers must acquire good understanding about the property of repair materials for lasting solution. For example, polyurethane base waterproofing coating such as Sikalastic 450 has its limit. When cracks develop the membrane will have an endless elongation, therefore the membrane will crack. If hairline crack with approximately 0.08mm width was not sealed prior to the application of membrane the crack tends to widen by 450%. Therefore the membrane will break once the crack width reaches 0.36mm (0.08mm x 4.5) wide. Failing to understand such fundamental, building maintenance would be unnecessarily costly.

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